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EDITORIAL

Eat more fruit. Fruits have now come to be recognised by the physicians and dieticians as an essential part of healthful diet all the world over. They are said to contain base-forming elements in abundance to correct the harm caused by the acid-forming foods that form the more common diet of an average Indian. Generally he is not known to take to a liberal use of fruits excepting on festive occasions. He still labours under a mistake that the fruits are costly luxuries intended only for the well-to-do classes. Part of his apathy is due perhaps to his general poverty and a part to the lack of knowledge to appreciate the value of fruits. He does not know yet that fruits have in them wonderful health-giving substances in abundance and they must be taken as an article of food in liberal quantities to keep him fit and free from ills.

Dearth of fruits should not be a factor to keep off people from developing the fruit eating habit. Fortunately for us we live in the Tropics which grow a wide variety of fruits in plenty. Though apples, plums and peaches require higher elevations, the bulk of fruits like the mangoes, plantains, oranges, guavas, papaya, sapota, bher, tomatoes, grapes etc., can be raised with ease in the plains and there will be no necessity to import them from elsewhere. The railways now afford speedy transport for transhipment of the produce from the production centres to the regular markets. Provision of cold storage facilities will come into existence as a matter of course when a demand for fruit is created among the people by persistent propaganda. With the Prohibition Act now in force in three districts and the possibility of its extension over the whole province, there will be more fluid money in the hands of the poorer classes who will be ready to spend it on fruits if they are induced to do so. Here, then, is an opportunity for the prospective fruit grower to increase the fruit production and make it available to the poor man at reasonable rates and capture a potential market. By so doing he will not only be benefiting himself but rendering a national service by raising the general level of health of the people. The fruit eating habit is bound to make them sturdy and hardy citizens in the long run.

The Government are keenly alive to this aspect of the problem and have opened a Fruit Research Station at Kodur, Cuddapah district, whose

function it will be to supply seedlings and grafts from pedigree stock to the fruit growers and help them with up-to-date technique in the art of fruit culture. There is a prospect of a few more stations being opened with a view to encouraging the fruit industry.

To stimulate the fruit—eating habit and fruit production we are endeavouring to publish a series of articles on fruits the first of which appears in the current issue under the title, "A note on the cultivation of bananas in the Madras Presidency".

Market Gardening. Though the cry of "back to the villages" is now more vehemently uttered and heard, the tendency still seems to be for the populace to move out into the urban centres, where industries like the textiles are becoming established. With the growth of such industries, concentration of population is bound to result round about them. Since this population has to depend upon the crop growers for its daily requirements of vegetables, fruits and flowers, a market is assured to any one who ventures to take to their production in the neighbourhood. Tomatoes, brinjals, chillies, jasmines, roses and chrysanthemums are a few among the produce that would find a ready sale. For cultivators situated far away, the bus and lorry furnish the quickest means of transport to market the products. It is well known that jasmines of Dharapuram are rushed to Coimbatore by bus and made available to the customers in time with all its freshness. There is little doubt that market gardening in the vicinity of our Indian homes has a good future before it and only a steady effort is needed to utilize the demand to one's own advantage.

A Note on the Cultivation of Bananas in the Madras Presidency.

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Introduction. The term banana includes all varieties of plantains, fruit or vegetable. Banana is an important commercial crop in South India. It yields very good profits especially when grown in the vicinity of cities, towns and places of pilgrimage. Though the banana is known to cultivators for very many years yet a large number of them do not know the proper method of its cultivation. During the recent banana survey in this Presidency many cultivators evinced keen interest in knowing the proper method of its cultivation. This short note is therefore intended to give in broad outlines some information on the method of banana cultivation. At the end of the paper some of the more common banana varieties are mentioned with short notes on each.

Soil and elevation. Banana can be successfully grown from sea-level to 5,500 feet in elevation in any kind of soil, black, red, clayey or sandy, provided there is enough water for irrigation and good drainage. Though banana needs a good deal of water it cannot stand water stagnation.

Preparatory cultivation. The land after the harvest of the previous crop should be ploughed well at least four times. After the second ploughing farmyard manure at 20—30 cartloads per acre should be applied and then the other two ploughings given. The interval between ploughings should be at least a week.

Season of planting. There is no particular season for planting banana suckers except that they should not be planted during the very cold months (15th November to 15th February) when the growth of plants in general is not vigorous.

Planting. Pits measuring $1\frac{1}{2}'$ cube should be dug in lines 7′ apart and in rows 8′ apart and exposed to weathering for a fortnight. Immediately before planting suckers, the pits should be filled to three-fourths with a mixture of half a Madras measure of wood ashes and surface earth, care being taken that the subsoil removed from the pits is not used in preparing the mixture.

Rhizomes for planting. Well developed sword-leaved suckers or young broad leaved ones should be removed without damaging the rhizomes four or five days previous to planting. All the roots of the suckers should be trimmed, damaged portions of the rhizomes, if any, cleanly sliced off and the suckers heaped in a shady place. On the day of planting, these suckers should be distributed one to each pit. Before planting, the top portion (pseudo-stem) of the sucker above the rhizome should be cut off obliquely to a height of one foot from the rhizome. The sucker is then planted upright in the centre of the pit in such a manner that the rhizome

portion is completely buried in the soil. The pit is then filled up with earth leaving about 6 to 9 inches of the sucker (pseudo-stem) exposed. The soil all round the suckers should be well pressed in order to give them firm stand in the pit.

A soaking irrigation should be given on the same day of planting or the next day. Subsequent irrigations are to be given once a week in loamy soils, once in three days in sandy loams and every other day in sandy soils. During monsoons, however, such frequent irrigations will not be necessary.

After Cultivation. The first *mamooti* hoeing should be given a month after planting and the subsequent hoeings as and when weeds appear. On an average 6 hoeings are to be given in the course of a year. The weeds especially the *korai* (*Cyperus rotundus* L.) should be removed with the rhizomes (nuts). Ploughing the area after the suckers have been planted is not advisable even though this practice is in vogue in some parts of the Presidency.

In heavy soils where there is water stagnation, trenches one foot deep and one foot broad should be dug between every two rows during the monsoonic months and the stagnant water drained off. With every *mamooti* hoeing these trenches should be cleaned and gradually deepened in order to facilitate easy drainage.

In soils which are well drained trenching is not necessary. In such soils the land should be formed into beds, each bed enclosing about 4 to 6 plants in order to economise irrigation and conserve rain water.

Manures and Manuring. Bulky organic manures such as well rotten farmyard manure, powdered *poonacs* of all sorts, tannery refuse, green leaf, etc., are generally applied. A dressing of Ammonium sulphate is found beneficial in certain localities. Wood ashes will increase the keeping quality of bananas.

When the young plants have put forth 6 to 7 leaves, soil all round the plants to a radius of 18" and up to the level of the roots is removed. Well rotten farmyard manure or in its absence powdered poonacs or tannery refuse is spread evenly all round the plants at rates 2 baskets, 1½ lbs., 2 lbs., respectively per plant and covered with earth. A soaking irrigation should be given immediately after manuring.

A second dose of manure should be given when the plants are about to flower. By this time the suckers would have put forth 7 to 8 leaves. Both the main plant and the sucker should be manured. Manuring in subsequent generations should be similarly done both for the main plant and the sucker at the time when the main plant is about to flower and the sucker has put forth about 7 to 8 leaves.

De-suckering. Young suckers will begin to sprout from the sixth month onwards. The first and the second suckers should be removed as they appear *with a portion of the rhizome* by a specially made crowbar without causing injury to the mother plant. The third sucker is allowed to come up for the succeeding generation. All suckers that come up subsequently

should be removed like the first and second, the object being that only one sucker is allowed to come up for the succeeding generation. When the main plant is harvested the sucker that was allowed to grow by its side becomes the main plant in the next generation. In this manner in the course of three years four bunches can be harvested from each stool. The crop in the fourth year can be left for the purpose of leaves and this time three to four healthy suckers can be allowed to come up in each stool. To meet any leaf requirements from the first year crop, one or two rows of plants all along the margins of the plantation may be set apart for this purpose and 3 to 4 healthy suckers allowed to develop in each stool.

Propping. If there be strong winds when the "trees" are in bunches or when the bunches are heavy, it is advisable to support individual plants with bamboo or *Agathi* (*Sesbania grandiflora* Pers.) props. Double or single props with a fork at one end may be used. In the varieties Bontha, Rasthali and Vamanakeli, propping is not necessary since the first two have very deep and strong root systems and the other is dwarfish.

General. The cone-like inflorescence (heart) should be removed after all the pistillate (female) flowers have developed into fruits. *Agathi* plants may be planted on the outskirts of banana areas as wind-break especially on the windward side. These plants, however, should be pruned periodically. These provide protection for banana plants, fodder for the cattle and food for the owner.

Common commercial varieties of bananas and their availability.

Poovan. (*Musa paradisiaca* Linn., var. *Poovan*)

Local names—Mysore, Bengala, Paleyangodan, Karpura Chakkarakeli, Vasana Chettu, Ginni, Adukku Namarai, etc.

One of the most popular banana varieties. It is a good fruit and can also be used as a vegetable. Suckers are available from Rajahmundry, Samalkota, Erode, Coimbatore, Trichinopoly, Tellicherry, etc. It thrives well in all soils and localities. The fruits are in great demand throughout the Presidency.

Rasthali. (*Musa paradisiaca* Linn., var. *Rasthali*)

Local name—Poo Bare, Rasa Bale, Anai Poovan, Poovan, Ari Poovan, Nattu Poovan, Desi, Mokiri, Amritapani, etc.

One of the best varieties of bananas exclusively used as fruit. The fruits have a good flavour and taste and there is a good demand for them throughout the Presidency. Suckers are available from Khandavalli (Tanuku, West Godavari District), Erode, Trichinopoly, Tellicherry, etc. It can be successfully grown in all soils and places.

Vamanakeli. (*Musa paradisiaca* Linn., var. *Cavendishii*)

Local names—Pacha Vazhai, Kabul Bale, Guja Bale, Kuzhi Nendran, Kooli Vazhai, Kooni Vazhai, Nila Vazhai, Kandy Vazhai, Mauritius, etc.

A good variety of banana exclusively used as fruit. The fruits have a fine flavour and taste and are in great demand in the Madras City. It can be grown in all soils and localities. It needs heavy manuring. It is a dwarf variety. The colour of the ripe fruit is greenish. Suckers can be had from Samalkota, Erode, Trichinopoly, Sadras near Madras, Trichur, etc.

Chakkarakeli. (*Musa paradisiaca* Linn., var. *Chakkarakeli*)

Local names—Thella Chakkarakeli, Then Kadali, Shahaja, Chakkara Kadali, Godaveri Chakkarakeli, Rajah Vazhai, etc.

The best of all the banana varieties exclusively used as fruit. It can be said of this variety as the King of the Bananas. The fruits have an excellent flavour and taste. The ripe fruits literally melt in the mouth. There is a great demand for the fruits at Rajahmundry, Samalkota, Madras City, etc. It can be grown in all soils and localities. Suckers can be obtained from Rajahmundry, Samalkota, Trichur, etc.

Virupakshi. (*Musa paradisiaca* Linn., var. *Vannan*, ecological type *Virupakshi*)

Local names—Virupakshi, Velli Vazhai, Mala Vazhai, etc.

It is a hill variety and thrives in mountainous tracts at altitudes between 3,500 to 5,000. It is an excellent fruit with fine flavour and taste. The fruits are not juicy and have a good keeping quality. There is a good demand for the fruit in all the southern districts. When grown in the plains, however, the variety deteriorates and the fruits lose their fine flavour and taste. Suckers can be had from Pannakkadu near Kodaikanal Road Railway Station.

Sirumalai. (*Musa paradisiaca* Linn., var. *Vannan*, ecological type *Sirumalai*)

Local names—Uduran Vazhai, Sirumalai, Mala Vazhai, etc.

This is also a hill variety of banana but thrives at less altitudes than Virupakshi. It is largely grown in the Sirumalai Hills of Madura District at altitudes between 2,000 to 2,500 feet Hence its name Sirumalai. The fruits have a fine flavour and taste and are slightly juicy. Like the Virupakshi they also have a good keeping quality. There is a good demand for fruits in all the southern districts and Madras City. When grown in the plains the fruits slightly lose their flavour and taste. Suckers can be obtained from Sirumalai near Dindigul.

Ney Mannan. (*Musa paradisiaca* Linn., var. *Ney Mannan*).

Local names—Vayakkattu Kai, Nattu Vazhai, Thiyyan Mannan, Kallu Vannan, Ney Vannan, Mala Mundi, etc.

This is a variety which is chiefly used as vegetable, but sometimes also used as fruit. As a vegetable there is a good demand for the unripe fruits in Madura, Ramnad and Tinnevelly Districts. The ripe fruits have very little flavour and taste. Suckers can be obtained from Dindigul, Tinnevelly, Madura, etc.

Nendran. (*Musa paradisiaca* Linn., var. *Nendran*)

Local names—Nendra Bale, Thiruvonan, Etthakka, Chengazhikodan, etc.

The most popular variety of bananas in the West Coast. There are two other sub-varieties in this, viz., Attu Nendran and Myndoli. The fruits as used both as vegetable and as ripe fruits. The ripe fruits being tough need steaming before use. The fruits have a very good keeping quality. Many preparations are made of both unripe and ripe fruits. The cultivation of this variety is at present chiefly confined to the West Coast. This variety, however, can be grown in other places as well. Suckers can be obtained from Calicut, Tellicherry. Trichur, etc.

Nalla Bontha. (*Musa paradisiaca* Linn., var. *Nalla Bontha*)

Local names - Pacha Bontha, Bonthan, Nattu Ka, Katta Bontha, etc.

This is a variety the fruits of which are mainly used as vegetable. There is a great demand for this in the Madras City and northern districts. It thrives in all soils and localities. Suckers can be obtained from Rajahmundry, Samalkota. Ponneri, Trivellore, etc.

Monthan. (*Musa paradisiaca* Linn., var. *Monthan*)

Local names—Silanti, Manga Bale, Ounda Bale, Manga Kai, Sodari, Thezhuthani, Thenali, Ponthan, Chetti Kaya, Nathaangi Monthan, Yenthala Monthan etc.

The fruits of this variety are chiefly used as vegetable, but sometimes also as ripe fruits. As a vegetable it is in great demand throughout the Presidency. The ripe fruits have very little flavour and taste. It thrives well in all soils and localities. Suckers can be obtained from Erode, Trichinopoly, Coimbatore, etc.

Notes on Perina Nuda Fabr., [Lymnt. Lepid.), and Its Natural Enemies.

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and

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Introduction. Fig trees are commonly regarded as being free from serious pests. They are, however, occasionally attacked by different species of caterpillars which assume some importance when found in large numbers. One such pest is *Perina nuda Fabr.* During the periods of abundance appreciable damage is done by the larvae of this pest which defoliate the trees, leaving only the midribs and larger veins of the leaves with ragged shreds of leaf tissue.

Perina nuda is reported by Hampson (1892) to occur throughout India, Ceylon and China and observed to feed on leaves of Mangifera indica (Barlow 1900) *Ficus indica* (Fletcher 1919), *F. religiosa* (Forsayeth 1884) and *Artocarpus integrifolia* (Lefroy 1909 and Swinhoe 1885). From Coimbatore it was first reported on figs in 1917 by Ramachandra Rao (1917).

Life History of the Pest. *Egg.* The eggs are generally laid in clusters on the under surface of the leaves. These are found in rows, each egg opposite the space between two eggs in the adjacent row and are placed close together.

The egg is almost cylindrical, rounded, tapering towards the end which is attached to the leaf. The micropyle surface is flat with a small depression at the centre. In general colour the egg when freshly laid is light pink. The micropyle surface is deep pink enclosed in a white circle which again is enclosed in a light pink circle. Measurements of a number of eggs averaged as follows: Length 0·7 mm. Width at the micropyle end 0·5 mm: Width at the attachment to the leaf 0·4 mm.

The egg period varies from 4—6 days. Table I gives the egg laying records of 12 females. The maximum number of eggs laid by a female was 409 and the minimum 57 the average being 203.

Larva. *(First instar.)* The larva gnaws a hole in the micropyle end of the egg and wriggles out of the shell. The general colour of a newly hatched larva which measures 1·8×·5 mm. is orange yellow to sulphur yellow. Head is of the same colour and wider than the rest of the body. The posterior portion of the latter is narrower than the anterior and light orange yellow in colour. Thoracic segments are sulphur yellow in colour with white hairs on them. The first two abdominal segments bear a median longitudinal dark stripe with two dark tuft-like growths on the lateral side of each segment. The third segment is sulphur yellow. The 4th, 5th and 6th segments bear a median longitudinal sulphur yellow stripe with a dark stripe on either

TABLE I. Oviposition record of twelve moths of *Perina nuda* Fabr.

Moth No.	Pair Emerged on	First batch: Eggs laid on	First batch: No. of Eggs	Second batch: Eggs laid on	Second batch: No. of Eggs	Third batch: Eggs laid on	Third batch: No. of Eggs	Fourth batch: Eggs laid on	Fourth batch: No. of Eggs	Fifth batch: Eggs laid on	Fifth batch: No. of Eggs	Sixth batch: Eggs laid on	Sixth batch: No. of Eggs	Total No. of Eggs.
1	8 10 35	9 10 35	232											232
2	9 11 35	11 11 35	8	12 11 35	5	13 11 35	12	14 11 35	72	15 11 35	56			153
3	9 11 35	12 11 35	5	13 11 35	43	14 11 35	115	16 11 35	16					179
4	9 11 35	11 11 35	15	12 11 35	43	13 11 35	11	14 11 35	44	16 11 35	10			153
5	9 12 35	12 11 35	86	13 11 35	10	14 11 35	19	15 11 35	24	16 11 35	60			199
6	10 12 35	12 12 35	8	13 12 35	9	14 12 35	25	15 12 35	198	16 12 35	33			273
7	17 1 36	19 1 36	273	20 1 36	52	21 1 36	40	22 1 36	8	23 1 36	15	24 1 36	21	409
8	25 1 36	29 1 36	26	30 1 36	40	31 1 36	250							316
9 F.11 M.15	2 36 2 36	17 2 36	4	18 2 36	10	19 2 36	12	20 2 36	21					57
10	18 2 36	20 2 36	2	21 2 36	35	25 2 36	35							72
11	19 2 36	21 2 36	155	23 2 36	85									240
12	19 2 36	21 2 36	23	23 2 36	40	25 2 36	74							158

side. The 7th segment is dark. The 8th is light orange yellow. The 9th and 10th bear long hairs. The first instar lasts 3—4 days.

(Second instar.) The larva immediately after the first moult measures 6 × 1·5 mm. Head is black: thorax is light greenish yellow. The 7th abdominal segment bears a glandular protuberance of pink colour. The second instar lasts 2—3 days.

(Third instar.) The larva immediately after the moult measures 6 × 2 mm. The general appearance of the larva is now distinctly black with a white median longitudinal band and with long white lateral hairs. Head is distinctly black. The 6th abdominal segment develops a globular and glandular protuberance of white colour. The 7th segment bears a similar protuberance of yellow colour. The third instar lasts 3—4 days.

(Fourth instar.) The larva immediately after the moult measures 8 × 3 mm. In general appearance the larva at this stage does not differ from the larva of the previous instar. The fourth instar lasts 2—4 days.

(Fifth instar.) The larva immediately after the moult measures 15 × 5 mm. In general appearance the caterpillar shows no distinct difference from the previous stage. Head is olive brown in colour. On the first thoracic segment two dullred coloured tufts of hairs are seen on the lateral sides. The fifth instar lasts 2—4 days.

(Sixth instar.) The larva after the moult measures 23 × 5 mm. There is a distinct change in the colour of the caterpillar. Head is of drab colour. Body segments bear a dorsal series of short tufts of blackish hairs with particularly long tufts projecting over the head and anal segments, and lateral tufts of longish grey and black hairs. The larva bears a dark sap green band broken by a whitish band on second, third and fourth segments, two red spots on the green band on the side of the second, third and fourth segments, and a sub-dorsal row of dark blue tubercular spots from the 5th segment. The sixth instar lasts 3—4 days. The total active larval life varies from 16—20 days. In the case of three females seven moults were however, noticed.

Pupa. The larva when full fed pupates in the leaf fold formed by the fibres of silken threads produced by the larva. The pupa is hairy and brightly coloured on the dorsal side and pale yellowish white on the ventral. The male and female pupae measure 16 × 5·5 mm. and 18 × 6 mm. respectively. The pupal period varies from 5—9 days.

Moth. The following description has been adopted from "The Lepidoptera of Ceylon" Vol. II by F. Moore (1883).

"*Male:* Forewing transparent, except at the base, which is obliquely covered with pale ochreous-brown scales; hindwing pale ochreous-brown, darkest towards anal angle; a transparent spot at the apex; thorax pale ochreous-brown, abdomen blackish, with narrow whitish segmental bands, anal tuft reddish-ochreous; head, palpi, and legs above pale reddish-ochreous; antennae brown.

Female; dull ochreous-white, the base of posterior border sparsely irrorated with minute black scales. Body dull ochreous-white; head, palpi, legs, and anal tuft pale ochreous. Expanse, ♂ $1\frac{3}{8}$, ♀ $1\frac{5}{8}$ inch."

Generally the moths begin to emerge in October. The females are much larger and have cream-white wings and body. On emergence the females are sluggish and dull in disposition and inactive at all times as compared with the males. During the day the moths are for the most part quiescent and become active just at dusk. The male lives from 3–10 days and the female from 5–11 days. The total life cycle varies from 27–39 days. Table II gives the life history records of 15 moths kept under observation.

TABLE II. Life History Records of Perina nuda, Fabr.

Ser. No.	Eggs laid on.	Eggs hatched on.	Egg period in days.	Pupated on.	Larval period in days.	Adult emerged on.	Pupal period in days.	Total life cycle.	Sex of the adult.
1	9 10 35	14 10 35	5	29 10 35	15	7 11 35	9	29	M.
2	9 10 35	14 10 35	5	29 10 35	15	7 11 35	9	29	F.
3	12 12 35	17 12 35	5	8 1 36	22	17 1 36	9	37	M.
4	12 12 35	17 12 35	5	11 1 36	25	17 1 36	6	37	M.
5	12 12 35	17 12 35	5	11 1 36	25	17 1 36	6	37	M.
6	12 12 35	17 12 35	5	14 1 36	28	19 1 36	5	39	F.
7	19 1 36	25 1 36	6	16 2 36	22	21 2 36	6	33	F.
8	19 1 36	25 1 36	6	13 2 36	19	18 2 36	5	30	M.
9	19 1 36	25 1 36	6	13 2 36	19	18 2 36	5	30	F.
10	19 1 36	25 1 36	6	16 2 36	22	21 2 36	6	33	F.
11	19 1 36	25 1 36	6	10 2 36	16	15 2 36	6	27	M.
12	19 1 36	25 1 36	6	14 2 36	20	19 2 36	5	31	F.
13	19 1 36	25 1 36	6	13 2 36	19	18 2 36	5	30	M.
14	19 1 36	25 1 36	6	14 2 36	20	19 2 36	5	31	M.
15	19 1 36	25 1 36	6	13 2 36	19	18 2 36	5	30	F.

The temperature and humidity at which the pest was studied are given below: –

TABLE III. Temperature and humidity at which the pest was studied.

Particulars.	October 1935	November 1935	December 1935	January 1936	February 1936
Mean Minimum temperature in shade	70·9°F	68 1°F	65·8°F	64·4°F	67 9°F
Mean Maximum temperature in shade	87·8°F	85·1°F	84 9°F	84·8°F	91·0°F
Mean humidity at 8 hours	78·9%	74·2%	75·1%	73·8%	75·4%

Natural Enemies. 1. An un-identified tiny Chalcid has been noted on the eggs of this pest.

2. *Megarhogas n. sp.* Mr. Muesebeck of the Bureau of Entomology, Washington to whom this Ichneumonid was sent for identification has

declared it to be a new species. The parasite attacks fairly grown up caterpillars. The egg is laid inside the body of the host and the grub feeds internally. A parasitised larva is dull and on the 5th day after it is parasitised it presents a bloated appearance. After another 5 days the parasite emerges by cutting a hole through the dried skin of the larva.

3. *Tricholyga sorbillans Wied.* This Tachinid parasite lays its eggs on the body of the larva. Each female generally lays 40—85 eggs distributed on several caterpillars. The eggs laid on a single caterpillar vary from 1—55. But when a parasite is supplied with a large number of caterpillars, it distributes its eggs on them. It generally attacks caterpillars which are about to pupate but even young caterpillars are also attacked and oviposited. The eggs hatch out in a day and generally the parasitised host presents a dull appearance and does not moult. The grubs after hatching enter the body of the larva and feed inside for 4 days after which they come out and pupate. Only 1—3 grubs come out from each host. The pupal period ranges from 12—14 days after which the adults emerge. The total life cycle of the parasite varies from 17—21 days. In some cases the parasite lays its eggs on a larva which pupates on the next day. In such cases the eggs hatch out and when the host pupates they live inside the body of the pupa from which the parasitic grubs come out later. The longevity of the females is 20—25 days and that of the males 10—15 days.

4. *Brachymeria euploeae Westw.* Like the Tachinid parasite, this Chalcid is also a larval parasite. The total life cycle is 12—14 days and only one parasite emerges from each host. This has also been collected on Plusia sp.

5. *Goryphus nursei Cam.* From the field collections of Perina nuda larvae, this Ichneumonid parasite has emerged. The same species has been observed at Coimbatore as a parasite of *Ocinara varians*, another pest of figs.

Remedial Measures. Lead arsenate or calcium arsenate when sprayed at a strength of ½ oz. in one gallon of water is found effective against the caterpillars. Dusting with flowers of sulphur as a repellent has also given satisfactory results.

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Large scale trials on the filtration of cane juice with the syphon filter.

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In a previous article by the author in the March issue of the Madras Agricultural Journal 1938, a simple design of filter for the filtration of cane juices has been described and the saving in time effected by its use in comparison with the ordinary filter has been recorded. The above trials were, however, carried out with a small-sized filter under laboratory conditions, using only comparatively small quantities of juice (about 50—70 lbs.).

To see if the new type of filter will work equally satisfactorily under large scale conditions, a bigger filter of the same pattern of the following dimensions was made of copper :—

Top diameter	1 foot 6 inches.
Bottom diameter	1 foot.
Vertical height	2 feet 6 inches.
Length of the syphon tube below the bottom of the filter	2 feet 6 inches.
Height of the syphon bend from the bottom of the filter	1 foot 3 inches.
Bore of the syphon	0·5 inch.

During this crushing season, a number of trials were carried out with this filter. It was found that the arrangement of the different filtering media within the filter viz., gravel, unactivated carbon and activated carbon with wire-gauze partitions between, as described in my previous article was a little cumbersome in large scale working and there was further the likelihood of the unactivated and activated carbons getting mixed up during final cleaning of the filter and interfering with their subsequent reactivation. It would of course, be more convenient if the desired rate of filtration could be obtained by using only one of the two carbons (either the activated or the unactivated) over the gravel layer.

Using unactivated carbon only in the filter, it was found that the rate of filtration was rapid ; but the clarification of juice was not quite satisfactory. A fair amount of carbon dust and other impurities passed through, thereby entailing additional labour and trouble for subsequent removal of these from the boiling, clarified juice. Use of activated carbon only both in the pan and in the filter produced no doubt a high degree of clarification ; but the rate of filtration was comparatively slower, though markedly greater than that with the ordinary filter.

It was further found that the filtration rate could be considerably improved by using in the filter an activated carbon recently heated and cooled and by allowing the carbon-treated and boiled juice to settle for 10 minutes and syphoning off the supernatant liquid into the filter. Below are recorded the results of some typical trials.

Particulars of treatment of juice and of filtering arrangement.		Amount of juice filtered.	Time taken for filtration.	Remarks.
1. 3 lbs. of activated carbon in the pan-gravel up to 1 foot height from the bottom in the filter—above that 10 lbs. of unactivated carbon.	(a)	263 lbs.	20 minutes.	Fine carbon particles passed through
	(b)	267 lbs.	20 minutes.	
2. 3 lbs. of activated carbon in the pan-gravel up to 1 foot from the bottom and 7 lbs. of activated carbon above.	(a)	268 lbs.	25 minutes.	Filtrate clear.
	(b)	232 lbs.	20 ,,	
	(c)	308 lbs	25 ,,	
3. 10 lbs. of activated carbon in the pan-gravel as above in the filter—10 lbs. of active carbon above the gravel layer.	(a)	982 lbs.	75 minutes.	Clear filtrate.
	(b)	1002 lbs.	60 ,,	,,
4. Juice boiled with 3 lbs. of activated carbon—allowed to settle for 10 minutes and the supernatant liquid syphoned off into the filter—the filter contained gravel up to 1 ft. height from the bottom and above this a layer of 7 lbs of reactivated carbon freshly heated.	(a)	275 lbs.	12 minutes.	,,
	(b)	280 lbs.	12 ,,	,,
	(c)	276 lbs.	15 ,,	,,
	(d)	303 lbs.	15 ,,	,,
5. 7 lbs. of active carbon in the pan. After boiling, allowed to settle for 10 minutes and the supernatant liquid syphoned into the filter which contained a gravel layer 1 foot thick and a 6 inch layer of reactivated carbon above.		700 lbs.	37 minutes.	Filtrate clear.

It will be seen from above that a rapid filtration is obtained by allowing the carbon-treated and boiled juice to settle down for 10 minutes and by employing in the filter activated carbon that has been recently heated and cooled.

As a result of the above trials, the following method may be recommended for securing rapid filtration of cane juices through activated carbon. The strained raw juice is raised* to the boil, the scums removed thoroughly and about 1% of activated carbon on the weight of juice added to the boiling juice in the pan. The boiling and skimming are continued for 10 minutes and the hot juice is transferred to a conical settling tank provided with a tap 3 to 4 inches above the bottom and is allowed to settle down for 10 minutes. The supernatant juice is then allowed to flow into the top of the filter through the tap or in the absence of a tap, the supernatant liquid may be syphoned off into the filter.

For receiving the juice, the filter must be got ready as follows. Coarse gravel (well cleaned) is placed up to a height of 1 foot from the bottom ; a wire gauze is placed above the gravel and a layer of activated carbon (preferably recently heated and cooled) about 6″ thick over the wire gauze. Water is allowed to flow through the filter through the syphon till all the air is completely driven away from the apparatus. With this arrangement, it has been found possible to filter 1000 lbs. of juice within less than one hour.

By employing two or three filters of this type and a settling tank, large quantities of juice may be filtered with sufficient rapidity.

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The Occurrence and Inheritance of Hairiness of Leaf Tip in Sorghum.

By

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In sorghum the following parts are generally hairy:— (1) the outer side of the triangular auricular junction between the leaf blade and the leaf sheath, (2) the place of insertion, of primary branches on the main axis of the panicle, of secondary branches on the primary branches, and of spikelet branches on the secondary branches, (3) the base of the spikelets (callus hairs), and (4) the pedicels of the pedicelled spikelets. In addition to these, the following parts may or may not be hairy:— (1) the nodal band (the extreme base of the leaf sheath), (2) the inner side of the auricular junction and (3) the glumes. In rare cases the edges of the midrib can also be hairy[1]. In this paper the occurrence and inheritance of hairiness on the tips of leaf blades in sorghum and the relation of the same to awns and stigmatic feathers, are recorded.

This hairiness manifests on the upper side of the leaf blade. The hairs are confined to about one-third its length from the tip. The hairs are spinescent, pointing in the direction of the tip of the leaf blade. They are usually about half to one millimetre in length and occur in rows along the veins. Towards the tip to which the veins converge, they get crowded. The flag, (the top-most leaf) shows this character best. In the leaves of seedlings under six weeks old this hairiness is not easily noticed. Hairiness is best seen in mature leaves about flowering time. In some varieties these hairs are deciduous; in others they persist even on dried leaves. There is a certain amount of variation in the manifestation of this character in pure lines. The hairs may be sparse and in some cases confined to the extreme leaf tips. In others, the hairs may be dense and extend to more than half the length of the leaf-blade. When the hairs are dense, the leaf-blades present a dullish green look. Against sun-light the hairs show off and glisten.

Among the sorghums, this character manifests in most of the following varieties; *S. durra* Stapf, S. *cernuum* Host, *S. caudatum* Stapf, *S. caffrorum* Beauv, and *S. nervosum* Bess. In *S. durra* the hairiness is sparse; in *S. caudatum* and *S. cernuum* the hairiness is dense. In the groups *S. Roxburghii* Stapf and *S. guineense* Stapf, this hairiness is absent with a few rare exceptions. Among wild sorghums leaf tip hairiness is met with in a few types of *S. sudanense* Stapf.

To pursue the inheritance of this character (which is so common) and its relationship to other plant characters, a cross was made between A. S. 60,

a variety of *S. durra* from Coimbatore and A. S. 4174, a variety of *S. Roxburghii* from N. Rhodesia. *S. Roxburghii* is noteworthy not only for the absence of hairiness on leaf tips but also for an absence of awns in the group and for a paucity of feathers at the tip of the stigma. It is mostly in this group that the basal feathered stigmas occur.[2] It may also be noted that in this group and in the allied *S. guineense* the glumes gape out and their edges roll in. The contrasting characters of the parents and the F_1 are presented in the following table.

TABLE I.

A. S. 60 × A. S. 4174

Character.	Parents A. S. 60	Parents A. S. 4174	F_1
Leaf tip	hairy	glabrous	hairy
Stigmatic feathers	fully feathered	basal feathered	fully feathered
Awn	long (5–7 mm.)	Nil	Nil
Leaf sheath	reddish purple	brown	reddish purple
Nodal band	glabrous	hairy	hairy
Grain colour	yellow with brown wash	white with red base	reddish brown

The F_2 and F_3 segregations for hairiness of leaf tip are given in table II.

TABLE II

Generation and family No.			Behaviour of progeny Leaf tip hairy	glabrous
F_2 A. S. 5420	...	...	146	45
,, 5421	...	...	131	37
F_3 A. S. 6292	...	...	168	60
,, 6293	...	...	175	62
,, 6294	...	...	168	57
,, 6295	...	...	181	66
,, 6296	...	...	205	75
,, 6297	...	...	160	52
Total of F_2 and F_3	...	...	1334	454

From the above table it will be noticed that a hairy leaf tip is a monogenic dominant to a glabrous tip.

The relationship between leaf tip hairiness and the awn is given in the following table.

TABLE III.

Generation and Family No.	Behaviour of progeny: Leaf tip hairy, Awn Nil	Leaf tip hairy, long (5–7 mm.)	glabrous, Nil	glabrous, long (5–7 mm.)
F_2 A. S. 5420	107	39	38	7
,, 5421	104	27	32	5
F_3 A. S. 6292	115	53	48	12
,, 6293	126	49	51	11
,, 6295	123	58	53	13
Total	575	226	222	48
Calculated at a 43% cross over value	585	218·3	218·3	49·4
	$X^2 = \cdot 5448$		$P > \cdot 90$	

The hairiness of the leaf tip is linked to the awn (5—7 mm.) with a cross over value of 43 per cent.

The relationship between leaf tip hairiness and the feathering of the stigma is given below.

TABLE IV.

Generation and family No.	Behaviour of progeny: Leaf tip Hairy — Stigma Fully feathered	Leaf tip Hairy — Basal feathered	Glabrous — Fully feathered	Glabrous — Basal feathered
F_2 A. S. 5420	126	20	24	21
„ 5421	114	17	18	19
F_3 A. S. 6292	140	28	30	30
„ 6293	147	28	27	35
„ 6295	150	31	31	35
„ 6296	170	35	30	45
Total	847	159	160	185
Calculated at a 25% cross over value	865·4	147·8	147·8	190
	$X^2 = 2{\cdot}4416$		P>·30	

Leaf tip hairiness and the feathering at the stigmatic top are linked with a cross over value of 25 per cent.

The relationship between hairiness of the leaf tip and the two organs, awn and stigma, being thus found out, the inter-relationship between awn and stigmatic feathering is given in the following table.

TABLE V.

Generation and family No.	Behaviour of progeny: Awn Nil — Stigma Fully feathered	Awn Nil — Basal feathered	Long (5—7 mm.) — Fully feathered	Long (5—7 mm.) — Basal feathered
F_2 A. S. 5420	106	39	44	2
„ 5421	100	36	32	0
F_3 A. S. 6292	107	56	63	2
„ 6293	120	57	56	4
„ 6295	116	60	68	3
Total	549	248	263	11
Calculated at 18% cross over value	544·2	259	259	8·8
	$X^2 = 1{\cdot}1213$		P>·70	

There is a linkage between the awn and the feathering of the stigma with a cross over value of 18 per cent.

The hairiness of the leaf tip being so common, the relationship of this factor with characters other than those affecting the related homologous awn and stigma, are given in the following table.

TABLE VI

Other characters	Leaf tip: Hairy		Leaf tip: Glabrous	
Hairiness of nodal band	hairy	glabrous	hairy	glabrous
Total of six F_3 families	793	264	278	98
Expected 9 : 3 : 3 : 1 ratio	803·81	267·94	267·94	89·31
The P factor of leaf-sheath colour	purple	brown	purple	brown
Total of five F_2 and F_3 families	501	141	158	51
Expected 9 : 3 : 3 : 1 ratio	478·69	159·56	159·56	53·19
The W factor of grain pericarp colour	yellow	white	yellow	white
Total of four F_3 families	540	182	191	67
Expected 9 : 3 : 3 : 1 ratio	551·21	183·75	183·75	61·25

It will be seen from the above table that the hairiness of the leaf tip is, in inheritance, independent of hairiness of the nodal band, the P leaf sheath colour factor and the W pericarp colour factor.

The above cross has given the following additional independent inheritances in relation to the awn and stigmatic feathering.

TABLE VII

Other characters.	Awn: Nil		Awn: Long (5—7 mm.)	
Hairiness of the nodal band	hairy	glabrous	hairy	glabrous
Total of four F_3 families	490	177	203	54
Expected 9:3:3:1 ratio	519·75	173·25	173·25	57·25
The P factor of leaf sheath colour	purple	brown	purple	brown
Total of three F_2 and F_3 families	338	94	110	29
Expected 9:3:3:1 ratio	·321·19	107·06	107·06	35·69
The W factor of grain pericarp colour	yellow	white	yellow	white
Total of two F_3 families	257	82	104	32
Expected 9:3:3:1 ratio	261·19	89·06	89·06	29·69

TABLE VIII

Other characters.	Stigma: Fully feathered		Stigma: Basal feathered	
Hairiness of the nodal band	hairy	glabrous	hairy	glabrous
Total of four F_3 families	545	180	199	68
Expected 9:3:3:1 ratio	558	186	186	62
The P factor of leaf sheath colour	purple	brown	purple	brown
Total of three F_2 and F_3 families	381	101	119	38
Expected 9:3:3:1 ratio	359·5	119·8	119·8	39·9
The W factor of grain pericarp colour	yellow	white	yellow	white
Total of three F_3 families	413	138	152	52
Expected 9:3:3:1 ratio	424·69	141·56	141·56	47·19

The hairiness of the node is also independent of the awn and of the P factor of the leaf sheath colour, as will be seen from the following table.

TABLE IX

Other characters	Node			
	Hairy		Glabrous	
Awn	Nil	Long (5-7 mm.)	Nil	Long (5-7 mm.)
Total of four F_3 families	490	203	175	54
Expected 9:3:3:1 ratio	519·75	173·25	163·25	57·25
The P factor of the leaf sheath colour	purple	brown	purple	brown
Total of two F_3 families	278	95	92	27
Expected 9:3:3:1 ratio	276·75	92·25	92·25	30·75

Summary. Many of the sorghum varieties have spinescent hairs on the tips of their leaves on the top side. A few varieties (especially *S. Roxburghii* Stapf) have glabrous leaf tips. In crosses between these two types, hairiness on the leaf tip has proved a monogenic dominant. This hairiness is linked to the awn with a 43% crossover value and to the feathering at the tip of the stigma with a 25% cross over value. The awn is linked to the feathering of stigmatic tips with 18% cross over value. The hairiness of the leaf tip is independent in inheritance of the hairiness on the nodal band, the P factor of the leaf sheath colour and the W factor of pericarp colour. The awn and the feathering of stigmatic tops are each of them independent in inheritance of the hairiness of the nodal band, P of leaf sheath and W of grain pericarp. The hairiness of the nodal band is independent of P of leaf sheath and W of grain pericarp.

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SELECTED ARTICLE

Minor Elements in Fertilizer Practice

By Prof. F. MENCHIKOWSKY

When Liebig established in the fifties—sixties of last century the theory of mineral nutrition of plants, he added to the nitrogen, oxygen and carbon, found in the air and the water, the following fundamental elements found in the ash of plants: potassium, calcium, silicon and manganese (1). This list has undergone little change in the course of years; only two more elements were added, namely iron and sulphur (2). The above mentioned elements form a large proportion of the mineral wealth of the solid surface of our planet: O–47·17%, Fe–4·44%, Ca–4·79%; Mg–3·76%; K–3·00%; S–0·11%; P_2O_5–0·25%. It is therefore, only natural that these became the basis of mineral plant nutrition. They exist in the soil in the shape of the following minerals: felspars, calcite, dolomite, apatite, gypsum and quartz.

Early and Modern Physiological Theories. The lack of elaborate methods of chemical analysis was responsible for the fact, that up to quite recently only ten

elements were considered essential for plant nutrition (3). Even to-day we do not know as yet their exact number, but they are undoubtedly much more numerous. It is quite possible that all elements found in the ash of plants, and they number more than 30, play a more or less active part in the life of plants. Minor elements are only those that are found in infinitesimally small quantities in the ash of plants. At the present state of our knowledge it is very difficult to define the exact place and part of all minor elements in the processes of nutrition and development in plants, but the importance of some of these grows clearer every day. During the last few years several cultivated plants have exhibited numerous physiological diseases, that can be cured by the introduction of infinitesimal quantities of manganese, zinc, copper, cobalt, boron or other elements into the nutritional solution or tissues of the plant organism.

How was discovered the part played by minor elements. Apart from the lack of appropriate progress in chemical practice, one of the factors, responsible for our ignorance concerning the role played by minor elements, was the predominant use up to a few years ago of natural manures, which contain always larger or smaller quantities of various mineral impurities among which are to be found also the minor elements. The astounding progress of chemistry and technical practices have led to the introduction of chemically pure fertilizers; these being much richer in soluble composition of N with K and P have ousted to a certain degree the use of natural pure products. The soil lost as a consequence of the disappearance of mineral impurities those minor elements, which play such an important part in plant nutrition according to our present time notions. The partial disappearance of these elements from our fertilizing practice was one of the causes, that brought about the appearance of new and hitherto unknown physiological diseases.

The amelioration of neglected soils leads to the discovery of the effect of minor elements. The use of chemically pure fertilizers, from which the minor elements have been removed by refining, did not cause any complications as long as these were applied only to fertile soils of a varied mineral composition. But as soon as these fertilizers were applied to poor soil, new diseases made their appearance. The latter, as we now know, are the result of the absence of any trace of such elements as manganese, copper, zinc and others. Thus, e. g., it was found that several of the minor elements are not present in the soils of Florida, which are but sand mixed with a small quantity of vegetable mould (humus). Sometimes, soil may be deficient of a larger proportion of one or another of the minor elements, depending on its geological origin.

The amelioration of a whole series of neglected soils in Northern Europe has revealed the existence of plant diseases known under the general title of reclamation diseases. One of these, namely 'Elana' is characteristic of sands, heaths and moorlands.

In Denmark this disease has been found on Calluna heath soil; a similar disease has made its appearance also in the ameliorated areas in Holland. This disease is successfully controlled by the use of town refuse, for the latter always contains traces of copper. The same reason was responsible for a speedy recovery following the addition of copper sulphate to the mineral fertilizer applied to the soil. C. S. Piper and his collaborators have recently shown that the so-called Coastal Sickness, observed among sheep in Southern Australia can be cured by increasing the fertility of pastures, as soon as copper salts are introduced into the soil (4).

The part played by minor elements in plant nutrition. Over and above those elements that, owing to their quantitative predominance, play a decisive

role in plant nutrition such as N, K, P, a group of minor elements have been lately assigned a peculiar position. Prominent among these are manganese, zinc, copper and boron. These elements, even when present in small quantities affect cultivated plants adversely but what is especially interesting is that their total absence is equally detrimental leading, as it does, to serious disturbances of the physiological activity of plants. Experiments carried out during the last 25 years show that it is possible to control various forms of physiological diseases by introducing into the general system of fertilization minimal quantities of the above mentioned elements. Already in 1911 Hudig (Holland) has demonstrated that oat spots could be cured by the introduction of manganese. Other Dutch scientists successfully fought physiological diseases of rye, oats, and horse beans grown in marshy soils with the help of copper salts. Boron proved an element especially valuable for the successful growing of tobacco, potatoes, beets and beans. Observations proved that the growth of sugar-cane was arrested whenever it developed in an environment deficient of boron. It then showed the symptoms of a serious disease namely 'pokkah-bong.' Maize is sensitive to the absence of manganese in the soil. These facts sufficiently prove that minor elements, which play such a role in the life of cultivated plants both in temperate and tropical countries should be taken into consideration on the initiation of a programme of nutrition and fertilization in our subtropical agriculture

Minor Elements in Citriculture. A very common disease of citrus plants known as 'mottle leaf' is not due to any infecting organism, but to the disappearance of chlorophyll from the leaves and arrested growth. If the disease is present in a mild form, one observes a decrease in the number of chloroplasts and a weakening of the photosynthetic activity of the leaves (5). In more serious cases the number of yellow leaves increases largely, while young leaves (of the new growth) grow smaller, not exceeding in very serious cases, 2·5 cms, in length. At the same time twigs dry up, frequently leading to the death of the whole tree. In some cases the disease attacks also the roots. The causes of this disease have been variousy diagnosed in the literature dealing with the subject: the presence of chlormein irrigation water (6) excess of urine in the manure, unbalanced K : Ca ratio. According to Johnston, however, the appearance of mottle leaf in a plant frequently coincides with the absence of zinc in its nutritional medium (7)

The use of zinc in the control of citrus diseases. The investigation of means to control mottle leaf revealed the fact that the use of manure brings about a weakening of the symptoms of this disease; the symptoms weaken even more when iron and zinc salts are used. W. H. Chandler, of the University of California, was the first to use Zn in the control of mottle leaf and little leaf in fruit trees. Before this iron sulphate was successfully employed in which was contained an admixture of zinc sulphate. On the advice of Chandler, Johnston also employed salts of zinc in the control of citrus diseases. The chemical used was zinc sulphate which was spread on the ground at a little distance round the tree. But the best results wers achieved, when zine sulphate admixed with some other substance was sprayed over the trees. Experiments made by Johnston in 1932-33 gave very positive results. In 1934-35, Parker carried out experiments to control mottle leaf in grapefruit (8). The trees were sprayed with a water mixture and albumin used as a medium. Trees which carried an average of 30%-40% of diseased leaves, not only recovered after treatment with zinc sulphate but also showed a marked increase of their general yield and an improved quality of fruit. Quantity of fruit by weight increased 199%, while the number of cases grew by 20·2%. Size, shape and rind of fruit improved in quality on trees treated with salts of zinc. Observation showed that grapefruit trees, the physiolgical activity of which has been seriously impaired by mottle leaf, react rapidly towards recovery on the admixture of zinc sulphate in their irrigation water.

The effect of boron on citrus trees. Haas and other research workers have proved, that though even small amounts of boron are detrimental to the health of citrus trees, yet infinitesimal quantities of the same elements are not only harmless to plants, but absolutely essential for their successful growth. Numerous experiments have shown that plants placed in an appropriate environment, but wholly deprived of boron revealed arrested growth and a series of pathological deviations. The following sickness symptoms were diagnosed as a result of boron deficiency in citrus plants (10) leaves curl up along the midrib; their colour turns brown or yellowish-green; midribs and veins develop a corky film which becomes detatched. Seriously affected plants grow multiple buds that die soon afterwards. The bark of branches (and in serious cases also that of the trunk) bursts in the internodes secreting an amber coloured gum. Roots turn brownish black, stop growing and die. Trees deprived of boron do not develop flowers and bear no fruit whatsoever. The internal anatomic and physiological changes in citrus trees revealed the character of these diseases on the inside. Cross sections show accumulation of gum in cambial parts, which disintegrate, this causing the separation of the bark from the xylem. Parts of the phloem become disorganised and the supply of sugar to the lower parts of the plants tops while it accumulates in the leaves. We are thus led to believe that in the absence of boron the tissues of citrus trees lose their ability to transform and transport the products of plant metabolism, the balance is shifted to one side, while toxic substances accumulate in the plant. As soon as one part per thousand of boron is introduced into the nutritive medium, not only new growth is stimulated, but the plant begins to recover generally. The secretion of gum stops, the sugar content of the leaves dropping simultaneously.

The Effect of Manganese Deficiency on Citrus Tree. Old literature abounds in references to the detrimental effect of even small quantities of manganese on plants. Loeb (1903), McCallum (II; 1913) and Branchley (1914) have shown that manganese is toxic even in a 1 : 100,000 ratio. Johnston (1917) opined that this effect is due to a lowered use of iron. On the other hand numerous experiments proved that the application of salts of manganese brings about increased fertility (especially in calcareous soils). Further investigations of the subject showed (12), that an admixture of manganese (1 : 5,000,000—1 : 10,000,00) favourably affects the growth of plants; on the contrary, green cells deprived of manganese are subject to autolysis, finally dying. Neither iron nor manganese are compound parts of chlorophyll, but both act as catalysers in the formation of the chlorophyll nucleus. The first symptoms of citrus diseases consequent on the lack of manganese were discovered, when citrus seedlings were grown in sand and water solutions into which iron had been introduced as a chemically pure substance (13).

Before such pure salts were used, no pathological symptoms had been noticed, for the usual compounds of iron introduced into the solution contained also an admixture of compounds of manganese. Observations carried out on citrus shoots grown in water solutions, that contained all necessary nutritive compounds with the exception of manganese, showed the following results; lemon twigs experienced great difficulty in their growth. The loss of leaves and even twigs prevented maximal development. In spite of liberal supplies of iron, leaves turned a chlorotic colour, as if no iron at all was available. But leaves never showed spotted colours. Both sides of leaves revealed gum spots, especially in the vicinity of midribs. Dead twigs showed gum-swellings, which secreted gum. Roots, however, remained healthy. As soon as a suitable proportion of manganese salts were introduced into the solution, plants recovered rapidly.

Exanthema and copper deficiency in citrus trees. Exanthema (die-back), which is a very common disease in Florida, is also considered a result of unsatisfactory plant nutrition, for the majority of Floridan soils is nothing but sand with a

slight admixture of organic matter (O. C. Bryand). The symptoms of this well known disease are gum pockets near the nodes, stained shoots and fruits, abundant growth of multiple buds, a very dark green colouration of leaves and an abnormal shape of the latter. Ozerkowsky and Thomas pointed out that copper deficiency is the cause of this disease in pear trees (14) Haas and Quale came to the same conclusion with regard to citrus trees (15). According to the latter investigators the leaves of affected trees show a decrease of the content of copper, while absolutely healthy trees, or such that have been attacked and are on the way to recovery following a treatment with copper salts, show an increase of the content of copper. A similar decrease of copper content was also found in the fruits of affected trees. Copper is, therefore, an essential factor for the health of citrus trees; a deficiency of this element brings about symptoms of exanthema.

Local soils and minor elements. The participation of minor elements in the nutrition of plants depends both on the proportion of the applied fertilizers as well as on the chemical composition of the soil. Local practice which prescribed an abundant use of organic manures in citrus plantations, had the additional advantage of introducing a sufficient quantity of minor elements, which were to be found in manure fertilizers. As the use of organic manure lessened from year to year ceding its place to highly refined mineral compositions, the situation changed, creating conditions favourable to arrested growth consequent upon a deficiency of minor elements. The data quoted above show, that poor sandy soils as well as ameliorated marshy soils do not as a rule contain these minor elements; this deficiency leads to the physical diseases enumerated above. The majority of our soils in the coastal zone belongs to the class of poor sandy soils. The above mentioned unfavourable change in fertilizing practice makes the plants dependent on these poor soils and leads to a corresponding unfavourable change in the conditions of growth and development. The problem of minor elements is important also in soils of other zones, as e. g. in the Jordan Valley, where an excess of calcium salts in the ground brings about the elimination of iron and manganese salt from the soil solution. In all cases of amelioration of marshy soils for purposes of growing citrus and other fruit trees or cultivated plants, proper attention should be paid to the role of minor elements in plant nutrition.

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Hadar 12 (1939) 47—49.

EXTRACT

Cinchona Cultivation in South India.

Species :—

(a) *Cinchona Ledgeriana* and its hybrids. This is the most valuable of the cinchona barks, having a high quinine sulphate content and low febrifuge alkaloid content but it has however the disadvantage of being a shortlived variety. It grows best at an elevation of from 3,000 to 4,000 feet.

(b) *Cinchona officinalis, uritusinga*, etc. These varieties are much easier to grow, having a long life but maturing rather more slowly than the other varieties. They grow best at an elevation of from 6,000 to 7,500 feet.

(c) *Cinchona robusta* and hybrids. These varieties are robust, relatively quick-growing and long lived. They grow at elevations of from 3,000 to 6,500 feet.

(d) *Cinchona succirubra*. The easiest variety to grow, doing well at elevations from 3,000 to 6,000 feet. The bark of this variety is usually used for pharmaceutical purposes and is of no manufacturing value unless cinchona febrifuge is required. The market demand for this variety of bark is relatively small.

Conditions for cultivation of cinchona. Favourable conditions for cinchona areas are undulating virgin jungle or reafforested lands, good drainage and a well distributed rainfall of between 40 and 100 inches per annum. Adverse factors are frost, exposure to wind, long periods of drought, lack of shade or shelter trees when plants are young and an excess of shade or shelter trees once the cinchona is well established.

Seed nurseries. From an ounce of cinchona seed, 4,500 plants should be obtained without difficulty. The seed must be sown under *pandals*, and one ounce of seed is required for not less than twenty feet length of a three to four feet wide seed bed. The ground to be used for these beds should be thoroughly cleaned and well dug to a depth of about two feet. The prepared ground may be subsequently covered with fresh jungle soil mixed with clean sand, the centre of the bed being slightly higher than the sides.

For watering the seed beds a fine spray is most important as excessive moisture invariably causes "damping off". Seeds will germinate in two or four weeks and great care must be taken to maintain uniform conditions. Direct sun's rays on germinating and young seedling beds are definitely harmful, yet proper ventilation is essential. Unless overcrowded, seedling can be left to attain the height of one inch before transplanting.

Field nurseries. Seedling may be transplanted direct into plant baskets for later field planting or, as is more usual, put out into field nursery beds four inches apart. These beds, which should be raised above ground level, can be

open or covered with *pandals* according to local conditions. The open beds are fern shaded in earlier stages. Before the plants are planted into the field they should have been hardened off by gradual exposure and decrease of watering. The plants should have a good root system, woody stems and be from 9 to 15 inches in height. For successful field planting the nursery beds must first be well-watered and plants then removed with a good surround of earth.

Experience has shown that early planting (i. e. as early as possible before the heavy rains) gives most satisfactory results especially in areas occasionally subject to a long and hot dry season.

Planting out. After clearing the area to be planted, pits (usually 1½ feet deep) are dug four feet apart. Pits dug during the dry weather should be filled after the first showers when planting can be commenced. At this stage shade trees can be interplanted sixteen to twenty feet apart.

Cultivation. Cinchona yields very readily to cultivation and manuring with cattle or green manures. Precocious flowers or seed pots should be removed when they occur and pruning where necessary should have as its objective a tree with a good single stem. It should hardly be necessary to add that forking is most beneficial and worth the extra expense. Absolute clean weeding in the very dry weather should not be undertaken.

Pests and diseases. Careful upkeep and improvement in cultural conditions is the best safeguard against disease. Various mould diseases and *Helopeltis* occasionally occur. The more serious mould diseases are best dealt with by cutting away the affected parts or complete removal of the trees. Ruthless rejection of sickly seedlings and nursery plants will do a great deal to ensure a healthy and successful plantation.

Harvesting. Apart from pruning and removal of sick trees there are two methods of harvesting cinchona, namely, coppicing or uprooting. The former is only recommended for hardy varieties. Considerable wastage of bark is avoided if saws are used instead of axes for felling and cutting up the tree prior to barking, which is done with pruning or bark knives.

Great care should be taken in the collection of root bark as approximately 25 per cent of the total bark of a tree is usually classified as root bark and the value of this bark is higher than that of stem if total alkaloids are taken into account. Bark collected from prunings and subsidiary stems of young trees will not be as valuable as that from the stem of a mature tree.

Similarly branch bark has a lower value than that from the main stem—the quinine content of the bark decreases towards the branches and branch ends. Dead bark and wood chips contain no quinine and their presence in harvested bark adversely affects the bark value.

Bark for manufacturing purposes need not be of any specific size, but it should be free from stones, sand and earth as well as wood chips.

Sale of bark for manufacturing purposes. Cinchona bark is bought according to the percentage of quinine it contains. Of recent years the Government of Madras have also paid for some of the febrifuge yielding alkaloids. A certain price is fixed upon per unit which means 1 per cent. of quinine sulphate or other alkaloid per one pound of cinchona bark. This price has varied but has remained constant for some years now; namely, 1⅜ annas per unit of hydrated quinine sulphate. In addition ½ anna per unit of cinchonidine and cinchonine alkaloids combined has recently been paid.

Although the Cinchona Department has in the past been only too willing to purchase all cinchona bark of manufacturing quality offered to it by local planters, it must be understood that Government do *not* guarantee purchase of all

cinchona bark likely to be grown by private enterprise. Production at the quinine factory is regulated by the demand of the market it serves.

Private enterprise. In order to assist local private enterprise Government will be pleased to allow persons who own plantations and those who are anxious to grow cinchona to visit their plantations. Such visits will be allowed on Mondays or Fridays between 10 a. m. and 12 noon on permits to be obtained from the Director, Madras Cinchona Department, Ootacamund. The plantation officers will receive these visitors and will give them such general advice as appears necessary to meet individual requirements. *Planters' Chronicle*, Vol. 24, (1929): No. 4.

Gleanings.

Milk Production Costs. The third year's working of the Milk Investigation scheme for England and Wales is reported by the Agricultural Economics Research Institute, Oxford, and deals with the 1936-7 milk contract period. This report shows that the cost of production on 437 wholesale farms was 9·55d. per gallon; these figures show an increase of a third of a penny per gallon over the previous contract period, and are not inclusive of any allowance for interest on capital, transport costs, etc. The report also states that in many cases rises in wage rates were counteracted by the installation of milking machines. (*Rural Electrification and Electro-farming* Vol. XIV. No. 167).

World's Milk yield record Broken. Messrs. Wort and Way, of Red House Farm, Amesbury. Wiltshire, are the proud possessors of "Cherry" the now famous Shortorn cow, who recently broke the world's milking record with a yield of 38,678 lb in 366 days, thus eclipsing the record previsously held by Terling Graceful 10th, a British Friesian, in the herd of Lord Rayleigh. Cherry is expected to reach 40,000 lb. by Easter. (*Rural Electrification and Electro-Farming* Vol. XIV. No. 167).

Camphorated Coconut Oil Popularised. During the Malarial Epidemic of 1935, an officer of the Medical Department discovered the solubility of camphor in coconut oil and used camphorated coconut oil for cases of pneumonia, asthma and bronchitis with successful results. The effects of camphorated coconut oil not being differant from camphorated olive oil, the coconut Board gave publicity to this matter and has considerably increased the use of coconut oil for this purpose in 1937 and later. (*Journal of Coconut Industries, Ceylon*, p. 301).

Coconut Paper Research Subsidised. Mr. S. R. K. Menon, a research worker from Travancore, made representations to the Board as regards an invention which he had elaborated with reference to the manufacture of paper pulp from coconut husk. The Board held a special meeting at which persons interested in the Coconut Industry were present and at which Mr. Menon explained the nature of his invention. It was generally accepted that there were two elements in his invention which were original and constituted an advance on previous attempts, viz. (1) separation of fibre from the husk by a chemical instead of a mechanical process, and (2) disintegration of fibre into paper pulp by raising the temperature of the disintegrating solution to a higher degree than the one generally adopted hitherto in the manufacture of paper pulp. At a meeting of the Board held on the 20th of December, the Board resolved to co-operate with the Coconut Research Scheme in affording facilities to Mr. Menon to pursue his investigations as regards the commercial possibilities of his invention and offered a maintenance allowance of Rs. 150 per month for Mr. Menon and Rs. 15 per month to an assistant and a travelling allowance for Mr. Menon for travelling, if necessary, for the above investigations. The Coconut Research Scheme has given Mr. Menon the necessary laboratory facilities for carrying on his investigations. It is expected that a success of the investigations will ensure a

new source of income to the Coconut Industry. *(Journal of Coconut Industries, Ceylon*, 2; p. 301—303).

Artificial Silk made from Cotton Linters. The Indian Central cotton Committee has been carrying on experiments in the first stage of artificial silk production by the acetate process and is determining the cost of producing chemical cotton from cotton linters, of which it is believed about 10,000 tons are now annually wasted in ginning and spinning. (*Tropical Agriculture* Vol. XVI. No. 4.)

Agricultural Jottings.

(*From the Director of Agriculture, Madras*)

MAHALI OR KOLEROGA DISEASE OF ARECANUTS

The areca cultivators are now aware that the most serious disease with which they have to contend is the *Mahali* or *Koleroga*. As the disease appears only after the outbreak of the monsoon, and as the measures taken for its control are only preventive, preparations should be started forthwith for having the gardens sprayed before the monsoon. On no account should spraying be given up assuming that the disease is not likely to appear this year. Growers should bear in mind that when once the disease breaks out in a garden, it is impossible to save the entire crop. Any number of sprayings given after the appearance of the disease can never equal in efficiency to the two sprayings given one just before the onset of the monsoon and the other about six weeks later.

Crop and Trade Reports.

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 16th June 1939 amounted to 2,91,312 bales of 400 lb. lint as against an estimate of 388,900 bales of the total crop of 1938-39. The receipts in the corresponding period of the previous year were 2,43,346 bales. 2,17,077 bales mainly of pressed cotton were received at spinning mills and 96,194 bales were exported by sea while 99,322 bales were imported by sea mainly from Karachi, Bombay and Egypt. (*From the Director of Agriculture, Madras*).

College News and Notes.

Students' Corner. The College re-opened on the 15th instant and students of the 2nd and 3rd year classes have assembled after the vacation.

Personal. We are glad to note that Rao Bahadur G. N. Rangaswami Ayyangar, F. N. I., I. A. S., has been elected as a member of the Council of the National Institute of Science of India, Calcutta, for the year 1939.

Birthday Honours. We are glad that Sri. K. Gopalakrishna Raju, Provincial Marketing Officer, Madras, is honoured with the title of 'Rao Bahadur' in the recent Birthday Honours. We offer our congratulations to him.

Committee on Co-operation. The Committee on Co-operation consisting of the following members met at the Freeman Hall of the Agricultural College on the 9th and held their sittings here till the 20th instant.

Members of the Committee on Co-operation. Sir T. Vijayaraghavacharya-(Chairman); Dewan Bahadur Sri.T. A. Ramalinga Chettiar, M.L.C. (Vice-Chairman); Abdur Rahman Khan Sahib Bahadur, M. A., B. L., M. L. A., Sri. K. Bashyam, B.A., B.L., M.L.A.; Diwan Bahadur Sri. K. Deivasikhamani Mudaliar, M.L.C.; Rao Bahadur Sri. M. Giriappa, B. A.; Sri. Kala Venkata Rao, M. L. A.; Sri. A. Karunakara

Menon, B. A., B. L., M. L. A,; Sri. V. Kurmayya B. A., LL. B., M. L. A.; Sri. K. A. Nachiappa Gounder, M. L. A.; Sri. B. Pattabi Sitharamiah; Hon'ble Sri. V. Ramados Pantulu, B. A., B. L.; Diwan Bahadur Sri. C. S. Ratnasabhapathi Mudaliar; Sri. N. Satyanarayana; Sri. M. Shiva Rao; Sri. J. Sivashunmughan Pillai, M. L.A.; Dr. P. J. Thomas, M. L. C.; Sri. R. Suryanarayana Rao; Sri. P. N. S. Ayyar, B. A.; and Sri. S. A. Venkataraman, I. C. S., Registrar of Co-operative Societies; Sri. B. S. Murthy, Parliamentary Secretary and Sri. K. Subrahmanyam Nayudu, M. A., Secretary to the Committee on Co-operation.

Visitors. Most of the members of the above committee on Co-operation, including the two honorary visitors, Messrs. A. Karunakara Menon and K. A. Nachiappa Gounder, availed of this opportunity to visit the Research Institute and the Agricultural College.

A batch of post-graduate students of the Imperial Dairy Institute, Bangalore, under the charge of Mr. K. Desai, Supervisor, visited the College Dairy on the 9th instant.

Mr. P. H. Rama Reddy, the Director of Agriculture, Madras arrived here on the 16th inst. on his way from Ooty to Madras and left this on the 17th instant. He revisited the College on the 22nd and left for Madras on the 27th instant.

The members of the Agricultural College Selection Committee consisting of the Director of Agriculture, Madras; the Principal, Agricultural College, Coimbatore; Sri. K. P. Mallikarjunudu, M. L. C. Advocate, Masulipatam; Sri. R. Venkatasubba Reddyar, M. L. A., Advocate, Tindivanam; Janab P. I. Kunhammad Kutty Hajee, M. L. A. Vice-Chairman, Calicut Municipality; and Sri. J. Siva Shanmugam Pillai, M. L. A., interviewed the candidates for admission into the Agricultural College on the 22nd instant.

Address Sri. B. Pattabi Sitharamiah addressed the members of the Madras Agricultural Students' Union at 4 p. m. on 17—6—'39, at the Freeman Hall under the Presidency of Mr. R. C. Broadfoot, Principal and President of the Union. Answering questions put by some of the members, he gave his experiences and views on farming, He requested the students to study rural problems and help the down-trodden people. In winding up the proceedings, the Principal and President of the Union asked the students to keep their eyes open, and after studying the rural problems, help in the improvement of agriculture.

Association of the Upper Subordinates. The Secretary of the Association of Upper Subordinate Officers of the Madras Agricultural Department writes under date 21st June '39:— "The Annual general body meeting of the Association of the Upper Subordinate Officers of the Madras Agricultural Department will be held during the "College Day Week" in the month of July 1939. All members of the Association are invited to be present at the function".

Students' Club. At the first General Body Meeting of the Students' Club held on 24—6—'39 with Mr. M. Kanti Raj, the Vice-President, in the Chair, the following students were elected as office-bearers of the Students' Club for the year 1939-40.

M. Mohan Punja	General Secretary.
K. Narayana Rao	Games Secretary.
R. Veeraraghavan	Tennis Captain.
Daniel Sundararajan	Hockey "
D. Narasimhamurthy	Foot-ball "
K. M. Somanna	Cricket "
M. U. Bhaskar Rao	Badminton "
K. S. Ramaswami	Volley-ball "
Noel Sreshta	Representative for class III.
S. N. Ramasubramaniam	" for class II,

The Late Rao Bahadur D. Balakrishnamurthi.

The Readers of the Journal will be sorry to learn of the demise, on Sunday, the 18th June, at Mukkamala, Ambajipet Post, East Godavari District, of Rao Bahadur D. Balakrishnamurthi, Retired Deputy Director of Agriculture, Madras Presidency, at the age of 67. The late Mr. Murthi was an alumnus of the Rajahmundry College. He later joined the Madras College of Agriculture at Saidapet in July 1898 where he took his diploma. He joined service on 18th September 1901 and was in the first batch of agricultural probationers selected for training in the Government Farms in the Bombay Presidency. On return he was first posted as Agricultural Inspector in charge of the Sugarcane Station at Samalkota and was later at Palur in South Arcot District in the same capacity. He was placed on special duty in connection with the Sugarcane enquiry in Madras which led to the organisation of a Sugarcane Station, first in this Province and subsequently, of a Sugar Department on an all-India basis, which since won world-wide distinction. At intervals he was selected for special duty in connection with the Palm disease operations in East Godavari district and the supply of indigo seed to the ryots in the Vizagapatam district during the Great War. He became the Assistant Director of Agriculture, Northern circle, on 3—12—1915 and was one amongst the first four Indians to whom the portals of the Indian Agricultural service were thrown open in 1921-22, his promotion to the Indian Agricultural service dating from 29th October 1921. He served in most of the districts of the Madras Presidency. He was professor of Agriculture and Superintendent, Central Farm, from 29th June 1922 till 25th May 1925. For a second time also, between 7th March 1927 and 21st May 1928, he served in the same capacity. For his services to Government he was created a 'Rao Bahadur' while he was the Dy. Director of Agriculture, Guntur, in 1930. A man of strong personality, he was industrious, and courageous in facing difficulties. After his retirement from service, from 16th December 1931, he spent his time and talents amongst the ryots and his kinsmen at Mukkamala.

We offer our sincere condolence to the members of the bereaved family.

Weather Review—MAY 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·3	-1·7	1·7
	Calingapatam	0·2	-2·4	1·1
	Vizagapatam	0·2	-1·8	2·9
	Anakapalli*	0·5	-1·9	2·1
	Samalkota*			
	Maruteru*	0·0	-1·4	1·4
	Cocanada	0·1	-1·9	2·8
	Masulipatam	0·0	-1·3	0·5
	Guntur*	0·6	-1·6	1·5
Ceded Dists.	Kurnool	0·0	-1·1	0·6
	Nandyal*	0·1	-1·3	0·5
	Hagari*	0·3	-0·7	0·6
	Siruguppa*	0·1	-1·5	0·2
	Bellary	0·9	-1·1	2·2
	Anantapur	0·2	-1·9	2·7
	Rentachintala	0·1	...	0·5
	Cuddapah	0·0	-1·6	1·7
	Anantharajupet*	0·0	-1·1	5·7
Carnatic	Nellore	0·0	-0·8	4·0
	Madras	0·0	-1·1	6·2
	Palur*	0·7	-1·2	12·5
	Tindivanam*	0·6	-0·9	6·8
	Cuddalore	2·3	+1·6	16·0
Central	Vellore	1·0	-1·3	8·6
	Salem	3·8	-0·9	11·0
	Coimbatore	0·7	-1·7	4·7
	Coimbatore A. C. & R. I.*	0·6	-2·0	4·3
	Trichinopoly	3·3	+0·3	10·8

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	4·7	+2·1	17·6
	Aduthurai*	3·4	+1·4	16·4
	Madura	2·4	-0·5	12·1
	Pamban	2·8	+2·0	8·3
	Koilpatti*	0·5	-1·4	5·9
	Palamkottah	1·0	-0·6	5·0
West Coast	Trivandrum	7·8	-0·7	15·9
	Cochin	8·5	-3·2	22·1
	Calicut	3·0	-5·5	10·0
	Pattambi*	0·0	0·0	0·0
	Taliparamba*			
	Kasargode*	0·2	-8·2	3·9
	Nileshwar*	0·3	-8·9	2·8
	Mangalore	0·0	-6·2	5·0
Mysore and Coorg	Chitaldrug	0·1	-2·9	4·8
	Bangalore	2·0	-2·4	9·1
	Mysore	5·8	+0·6	9·0
	Mercara	0·4	-5·3	2·8
Hills	Kodaikanal	1·7	-4·3	16·8
	Coonoor			
	Ootacamund*	4·9	-2·3	10·4
	Nanjanad*	2·0	-3·2	6·4

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette.

Associated with a temporary advance of the monsoon in the South East Arabian Sea on the 9th which weakened on the 12th and in the South Bay of Bengal on the 11th which continued to be active till the 21st, general rain has occurred in Malabar and scattered thunder showers in South East Madras and Mysore.

Skies were moderately to heavily clouded in South Madras, Mysore and the Madras Deccan; lightly to moderately clouded in Konkan and Malabar; and clear or lightly clouded elsewhere. Humidity was in defect in the Bombay Deccan and Hyderabad. Maximum temperatures were above normal in the Bombay Deccan and Hyderabad. Rentichintala and Cocanada recorded 114°F on the 29th and 30th instants respectively.

Rainfall was in large defect in all places except parts of the Carnatic and southern districts.

Chief amounts of rainfall.

Negapatam	3·4" on 7th.
Cochin	2·2" on 8th.

Weather Report of the Agricultural College & Research Institute Observatory.

Report No 5/39.

Absolute Maximum in shade	...	...	93·5°F
Absolute Minimum in shade	...	...	68·5°F
Mean Maximum in shade	...	...	95·9°F
Departure from normal	...	...	+0·9°F
Mean Minimum in shade	...	...	74·0°F
Departure from normal	...	...	Nil.
Total rainfall for the month	...	...	0·63"
Departure from normal	...	...	−2·0
Heaviest fall in 24 hours	...	...	0·20"
Number of rainy days	...	...	4
Mean daily wind velocity	...	...	3·6 m. p. h.
Departure from normal	...	...	Nil.
Mean humidity at 8 hours	...	...	67·9%
Departure from normal	...	...	−2·3%

Summary. Usual hot weather conditions prevailed during the month. The skies were moderately to heavily clouded with frequent thunder and lightning. The mean maximum temperature was above normal, while the mean minimum was normal. The mean humidity was below normal. The rainfall for the month was 0·6" which was far below normal.

P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notification.

1. Transfers.

Name of officers.	From	To
Sri E. Kunhappa Nambiar,	Offg. A. D. A., Tinnevelly,	Offg. A. D. A., Madura.

2. Leave.

Name of officers.	Period of leave.
Sri V. T. Subbiah Mudaliar, A. D. A., Tirupattur.	L. a. p. for 17 days from 1—6—1939.

Subordinate Services.

1. Posting.

The following officiating appointments in the III Grade have been ordered from 21st June 1939.

Name of officers.	Posting.
Sri B. M. Pinto.	Offg. A. D., Hospet.
„ J. Gopal Rao.	Offg. A. D., Nellore.
„ R. Shanmukasundaram	Offg. F. M., D. F. S., Hagari.
„ D. Rama Rao.	Offg. F. M., D. R. S., Hagari.
„ S. Lakshminarayana Pantulu	Offg. A. D., Nandyal.
„ K Satyanarayanamurthy.	Offg. A. D., Madanapalle.
„ K. Purushotham.	Offg. A. D., Anantapur.
„ N. Venkayya.	Offg. A. D., Kavali.
„ J. V. Suryanarayana.	Offg. A. D., Rajampet.
„ R. H. Krishnan.	Offg. A. D., Sriperambudur.
„ C. Hanumantha Rao.	Offg. F. M., A. R. S., Siruguppa.

2. Transfers.

Name of officers.	From	To
Sri R. Anantapadmanabha Pillai,	A. D., Nandyal,	A. D., Mudukalathur.
„ B. N. Padmanabhan,	A. D., Bellary,	A. D., Gingee.
„ G. Doraiswami,	Offg. F. M., Siruguppa,	A. D., Ariyalur.
„ S. Mahadeva Ayyar,	A. D. under training at Kodur,	A. D., Kodaikanal.
„ A. Krishnaswami Iyer,	A. D., Kodaikanal,	A. D., Madura.
„ T. Gopalan Nair,	A. D. under training at Kodur,	F. M., A. R. S., Taliparamba.
„ K. Rajabapanaiah,	A. D. under training at Kodur,	F. M., Guntur.
„ V. S. Rangacharlu,	F. M., Guntur,	A. D. under training at Bellary.
„ S. Kanakaraj David,	Offg. F. M., D. F. S., Hagari,	Asst. in Paddy, A. R. S., Pattambi.
„ K. Meenakshisundaram,	Offg. F. M., D. F. S., Hagari.	A. D., Dharmapuri.
„ K. Venkataswami,	Offg. A. D., Madanapalle,	A. D., Palladam.
„ C. Annamalai,	F. M. under training at Kodur,	A. D., Puthur.
Janab Muhammad Ali Saheb,	A. D., Puthur,	A. D., Gudiyattam.
Sri S. Kuppuswami Ayyangar,	A. D. (on leave),	A. D., Saidapet.
„ T. K. Mukundan,	A. D., Cannanore,	Offg. F. M., Central Farm, Coimbatore.
„ L. Neelakantan,	Asst. in Cotton, A. R. S., Nandyal.	Asst. in Cotton, A. R. S., Koilpatti.
„ S. Mayandi Pillai,	Asst. in Cotton, A. R. S., Koilpatti,	Asst. in Cotton. A. R. S., Nandyal.
„ R. Krishnamurthi,	Offg. Asst. in Cotton, A. R. S., Koilpatti,	Asst. in Cotton, A. R. S., Nandyal.
„ M. L. Balasundaram,	Offg. Asst. in Paddy A. R. S., Maruteru,	Offg. Asst. in Paddy, A. R. S., Buchireddipala.
„ M. C. Menon,	A. D., Tirupathur,	A. D., Cannanore.
„ M. Gopala Unnithan,	A. D. (on leave),	A. D., Tirupathur.
„ M. K. Gopalan,	A. D., Proddatur,	Sugarcane Grower's Co-operative Union, Hospet.
„ A. K. Annaswami Ayyar,	F. M., L. R. S., Hosur,	III circle, Tinnevelly.

3. Leave.

Name of officers.	Period on leave.
Sri B. L. Narasimham, A. D. Narasarapet.	L. a. p. for 13 days from 5--6--39.
„ K. C. Thomas, Offg. F. M., Central Farm, Coimbatore.	Extension of leave, without allowances for one year from 12--6--39.
„ K. L. Ramakrishna Rao, Asst. in Cotton, A. R. S., Koilpatti.	L. a. p. for 15 days from 5--6--39.
„ P. V. Samu Ayyar, A. A. D. (on leave).	Extension of l. a. p. on m. c. for 3 weeks from 6--6--39.
„ K. Ramaswami Ayyar, A.D., Palladam.	L. a. p. for 3 months from 5--6--39.
„ R. Venkataramana Ayyar, A. A. D. (on leave).	Extension of l. a. p. for 3 weeks from 29--5--39.

Sri C Annamalai, F. M. under training at Kodur.	L. a. p. for 1 month and 1 week from the date of relief.
,, M. Kalimuthu, Teaching Asst. Coimbatore.	L. a. p. for 13 days from 2—6—39.
,, R. Narasimhachariar, A. A. D., Entomology.	L. a. p. for 1 month from 1—6—39.
,, M. Kandaswami, A. D., Koilpatti.	L. a. p. for 1 month from the date of relief.
,, P. V. Hariharan, Asst. in Millets (on leave).	Extension of l.a.p. on m. c. on ½ average pay for 6 months from 11—4 -39.
,, K. V. Seshagiri Rao, A. A. D., Atmakur.	Extension of l. a. p. for 1 month from 8—6—39.
,, C. Vadamalai, A. D., Hindupur.	Earned leave for 2 months from 1-6-39.
,, C. A. S. Ramalingam Pillai, A. A. D., Ariyalur.	Extension of l. a. p. on m. c. for 2 months from 21—5--39.
,, P. Kesavanunni Nambiar, A. D. (on leave).	Extension of l. a. p. for 1 month.
,, S. Ramachandran, Rice Research Station, Buchireddipalayam.	L. a. p. for 3 months and 15 days from the date of relief.
,, M. K. Swaminatha Ayyar, A. D., Dindigal.	L. a. p. for 1 month from 19—6--39.
,, K. Govindan Nambiar, F. M., A. R. S., Taliparamba.	L. a. p. for 4 months from the date of relief.
,, V. G. Venkataramana Rao, A. D., Palmaner.	L. a. p. for 17 days from 14—6—39.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during May 1939

A. Books.

1. *Soils and Soil Management.* Millar, C. F. (1937). 2. *Geology of India.* Wadia, D. N. (1939). 3. *Paddy Breeding (Collections of reprints of Scientific articles).* Ramiah, K. (1936). 4. *Cotton.* Brown, H. B. (1938). 5. *Report on the Prospects of Cinchona cultivation in India.* Wilson, A. & Mirchandani, T. J. (1939). 6. *Report on the cost of production of crops in the Principal Sugarcane and Cotton Tracts in India.* Vol. 1—Punjab. (1938). Vol. 2—Bombay. (1938). Vol. 3—United Provinces. (1939). Vol. 8—Sind. (1939).

B. Annual Reports of Agricultural Departments & Agricultural Stations.

1. Madras Agricultural Station Reports, 1937—1938. 2. New Delhi Agricultural Research Institute Scientific Reports, 1937—1938. 3 & 4. Bengal Agricultural Department Annual Reports in 2 parts, 1937—1938. 5 & 6. Central Provinces and Berar—Agricultural Department Report on Demonstration work in the Eastern Circle, 1937--1938 and in the Southern Circle, 1937—1938. 7. Ontario Agricultural Department Annual Report, 1937—1938. 8. Madras Co-operative Department—Administration Report, 1937—1938.

C. Bulletins Etc.

9. The progress of Agricultural Science in India during the past twenty-five years—G. W. Burns (I. C. A. R. Miscellaneous Bulletin 26). (1939).

D. New Periodicals.

1. Journal of the American Society of Farm Managers and Rural Appraisers.